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INTRASEASONAL AND INTERSEASONAL VARIATIONS IN AVERAGE WEIGHT OF COLUMBIA RIVER CHINOOK SALMON (ONCORHYNCHUS TSCHAWYTSCHA).

1939 - 1945

by

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INTRODUCTION

This report, like previous publications on the same subject (Rich, 1940; Chapman, 1940) is concerned with weights of chinook salmon primarily as a means of converting catch statistics from poundages to numbers of fish. The converted data are of great value for use in conjunction with counts from Bonneville and Rock Island dams. When the catches in numbers of fish and the dam counts are used together they permit the estimation of total number, percentage catch and percentage escapement for various parts of the chinook salmon runs; data of obvious worth in connection with evaluation of the effect of dams and with administration of the fishery. Of particular value in studying the effect of dams is the determination of the proportion of the run migrating to various sections of the river, which is also facilitated by use of converted catch statistics.

For aid in orienting the reader it may be well to repeat that fishing for chinook salmon in the Columbia is done over a fishing season of several months (most of the catches are made from May through September), during which marked changes in the average size of the fish are observable. Also it is equally certain, although less obvious, that there are distinct between-season changes (Chapman, 1940). Another fact closely related to the subject of average size of fish in the catch is that the gill net, (particularly the "Floater" or simple drift gill net) most important form of gear on the Columbia, is highly selective in its fishing action.

The purposes of the present report are to present new material on average weights for the years 1940-45, to provide estimates which can be used to fill gaps in the data, and to devise a sampling system which will serve as a basis for obtaining information on average weights in the future.

SOURCES OF DATA

The statistics for the period 1939-42 were furnished by various canning companies along the river, that recorded numbers of fish as well as weights for large numbers of fares delivered to them. Opportunity is here again taken to extend thanks to these companies, without whose cooperation the study would have been impossible.

All of the data for the 1943-45 seasons were collected by the junior author, who gathered them incidentally to the collection of marked fish for the United States Fish and Wildlife Service at Astoria, Oregon. He secured measurements of a series of samples in 1943, and a large number of weights and counts for individual loads of fish in 1944 and 1945.

Catch data referred to herein have been secured directly from the Oregon Fish Commission and the State of Washington Department of Fisheries, or from statistical bulletins published by these agencies.

STUDY OF THE 1939-42 DATA

General Characteristics

Information gathered during the first four years of the study was much more detailed than that of the last three years, and the statistical analysis is therefore largely confined to data from the earlier period. In presenting statistics on average weights it is necessary to point out that since the data are intended primarily for use in converting catch figures from pounds to numbers, they are partitioned according to the same river zones as the catch figures. Catches of salmon are reported in both Washington and Oregon by zones whose boundaries correspond to those of the six Washington counties bordering the north side of the commercially fished portion of the Columbia River. These are: Zone 1, Pacific County; Zone 2, Wahkiakum County; Zone 3, Cowlitz County; Zone 4, Clark County; Zone 5, Skamania County; Zone 6, Klickitat County.

A preliminary survey of the data showed that there were only minor differences in weight of salmon caught in the three central zones of the river (Zones 3-5), and these were therefore combined to form a single river section. This combination reduced for compilation purposes the number of river divisions to four: Zone 1, Zone 2, Zones 3-5 and Zone 6.

Turning from geographical to temporal divisions, a series of seven-day periods beginning with May 1 has been devised in the past (Rich, 1942), and found practical. The units thus formed are comparable from year to year, since each (during the period March-August) contains one of the weekly closed periods extending from six p.m., Saturday to six p.m., Sunday. Also, the relationship of the seven-day periods to other closed seasons (May 20-June 10 and August 26-September 10) is the same from year to year. The main fishing months (May-September) contain 22 periods, and the balance of the year has been divided into periods consecutive with these.

All of the available data on average weights of chinook salmon for the period 1939-42, summed by weeks and river sections, are presented in Tables 1-4. It had been hoped that the within-season variations in average weight would be sufficiently regular that a fixed pattern could be recognized and fitted with some type of mathematical expression, thus obviating annual determinations for each individual week and river section. The data for Zone 1 in 1939 do, in fact, exhibit considerable regularity, and Rich (1940) found it possible to satisfactorily graduate them with two intersecting straight regression lines. Unfortunately, however, the balance of the data when presented graphically (Figure 1) do not exhibit any regular and consistent pattern.

Although there is a general tendency for the average weight to increase until around July 1 and then to decrease to the end of the season, there are exceptions to even this broad generality (see particularly the 1942 season in Figure 1). In general the short-term fluctuations within seasons are too great to be considered merely deviations about a trend. Also there are marked changes in general level of weight from season to season, as may be seen by comparing the 1939 and 1942 Zone 1 weights in Figure 1. Since neither the general level nor the pattern of change is constant, it becomes necessary to devise a system of gathering weight data which will provide information for each river section and time period for each season: this should be accomplished with the minimum possible expenditure of effort. We have here essentially a sampling problem, which will be treated in the next section of this report.

SAMPLING ANALYSIS

Sampling Within Zones.---In attacking the problem of setting up a sampling system for the determination of average weights of chinooks the 1942 data were used, since material for the lower river zones in that year was the most extensive of any collected during the entire period 1939-42. Three fish-receiving stations were selected for study designated below as "A", "B", and "C". The objective was to determine how closely a relatively small number of samples from these would represent the weekly average weights as determined from all samples for all stations covered. In doing this it was assumed that the "all-station" means represented the "true" means for the particular river zone under consideration, since "all-stations" included the majority of the stations within each zone receiving fish during the period of study.

As a first experiment it was decided to study the reliability of the mean weight of a single load per week from an individual station as a basis of estimating the mean weight for all loads weighed from all stations sampled. The average weight of the first load of fish each week at each of the three selected receiving stations was taken for study. When the first load contained less than 10 fish additional succeeding loads were taken until the total equaled or exceeded 10 fish.

Description of the statistical analysis to follow will necessitate reference to mean weights of a number of different categories, and to avoid confusion the terms to be used will now be defined. First, we have the mean weight of a single sample of salmon landed at a single receiving station consisting of the first one or more loads taken during a given week totaling at least 10 fish; this will be referred to as a "single-station weekly mean". Contrasted with this is the mean weight of all the salmon weighed in a fishing zone at all available stations during an entire week, which will be called an "all-station weekly mean." The mean of the three single-station means for any week will be referred to as a "three-station weekly mean."

The single-station and all-station weekly means for Zone 1, 1942 are given in Table 5 and Figure 2, covering only the periods for which sufficiently extensive data are available. The first three columns of table 5 give the single-station means and the last column the all-station means. In addition the fourth column of Table 5 gives the three-station weekly means; these are not shown in Figure 2. It will be noted that the all-station weekly means are weighted according to the number of fish in the samples, whereas, the three-station weekly means are unweighted means. The reason for this lies in the fact that the samples for the all-station means are roughly proportional to the catch they represent, while the number of fish in the single-station samples depends merely on how many salmon happened to be included in the first load (or loads) of the week.

In practical application of catch statistics converted by use of our average weights it is likely that means for periods longer than a week will be used; periods related in some manner to biological divisions of the chinook salmon runs. The single-station and three-station means for such periods (defined as in Rich, 1942) were accordingly calculated, and are given in Table 6. In calculating these period means the individual weekly means were weighted in accordance with the total catch within each week, as is appropriate where the resulting data are to be used in converting catch statistics from pounds to numbers.

To statistically analyze the reliability of the single-station and three-station period means as estimates of the corresponding all-station means the weekly values in each of the first four columns of Table 5 were subtracted from the corresponding ones in the last column.

This procedure yielded a series of deviations about the all-station means which were used in calculating root-mean-square errors of the various period means (Table 6). By use of Student's (Fisher, 1941) t distribution these errors were converted to fiducial limits theoretically including 95 percent of all possible observations on material of the same characteristics. These limits are also given in Table 6, expressed both as poundages and as percentages of the corresponding mean weights.

The "root-mean-square errors" just referred to differ from the conventional "standard error of the mean" in two respects: (1) the deviations used are deviations from all-station values rather than from the mean of the single-station values: (2) in making the calculations each deviation was weighted by the total catch in the appropriate week, resulting in a weighted mean deviation. Both of these departures from standard procedure were necessary because of peculiarities in the data used. In the first instance we find that there is a distinct trend of average weight (Figure 2), even within short periods. Use of deviations about means within these periods would result in values much too large, and would not give a correct approximation of the variability of the single-station means about the "true" means. Secondly, the catch of chinook salmon fluctuates tremendously during the fishing season; obviously a deviation during a period of heavy catches is much more serious, where the data are to be used in converting catch statistics, than one during a period of light catches, and the weighting process described above takes account of this effect.

Another minor departure from usual procedure was made in calculating mean variance. Ordinarily in dealing with small samples the sum of the squared deviations (Σd^2) is divided by one less than the number of items (N-1) since one degree of freedom is lost in calculating the mean from the individual values. In our calculations, however, deviations were taken not about the mean but about the all-station values, which are independent of the single-station values. Therefore, no degrees of freedom were lost and the mean variance was taken as d^2/N.

Turning to the results of the calculations, much variation in magnitude of errors from station to station and from period to period is revealed (Table 6). This variation does not seem to be consistent, since for instance, the greatest error for the period May 1-28 is found at Station C, while for the period July 31- October 1 it is at Station B. It is to be noted that the 95 percent fiducial limits for the three-station means do not exceed five percent of the "true" values except for the period May 1-28, where the effect of the small number of observations (four at each station) is felt.

As a check on the foregoing computations, and to detect any possible peculiarities associated with the particular zone or stations used, the entire analysis was repeated using data from three stations ("D", "E" and "F") in Zone 2. Because of the small number of samples

weighed in Zone 2 near the beginning of the season, it was necessary to use the period June 5 - October 15 instead of the previous May 1- October 1. This change in season covered of course eliminated from all comparisons the sub-period May 1-28. The Zone 2 results are given in Figure 3 and Tables 7 and 8.

In terms of weighted period means the Zone 2 data (Table 8) are similar to those for Zone 1 (Table 6). Although there are no Zone 2 data for the early part of the season (May 1-28) the roughly comparable later periods show much the same percentage variation within the 95 percent fiducial limits; what difference there is seems to lie in the direction of somewhat greater variability in Zone 2, for the period June 5 - July 30. Note that the three-station season fiducial limits are ± 3 percent for both zones.

To put the foregoing results to use in setting up a sampling procedure for determining average weights of Columbia River chinook salmon, it is first necessary to decide upon the desired level of accuracy. In any practical use of the catch data converted by means of the average weights it will be necessary to make a number of assumptions regarding distribution of spawners, etc., such that it is unlikely that any observed difference or effect amounting to less than 10 percent of the quantity in question can be considered significant. It is conventional in statistical practice to consider that an observation is significantly different from another one if it lies outside the 95 percent fiducial limits of the other. Thus if the 95 percent limits of the calculated average weights lie within 10 percent of the observed values, sufficient accuracy is present to enable the detection of significant differences or effects greater than 10 percent.

Tables 6 and 8 may be examined to determine how extensive sampling must be in order to secure the desired 10 percent or smaller fiducial limits for period and season means. Such an examination reveals that sampling at any single station would yield the required degree of accuracy for season means. As regards period means sampling at three stations would be required, and would be adequate except in the case of the period May 1-28 (Table 6). The figure here (18 percent) is considerably outside the permissible 10 percent range; on the assumption that the error varies inversely as the square root of the number of samples it would require 1.8^2 or $3.^2$ times as many samples to reduce the error from 18 percent to 10 percent.

Interzonal Comparisons.-- In the preceding section the problem of sampling was considered in the light of weight variations within river zones; the matter of variations between zones as related to sampling will now be taken up. It is pertinent to inquire in this connection whether the differences between average weights for adjacent river sections are statistically significant. This can be readily tested by computing the differences between weights for corresponding weeks of adjacent zones and applying Student's (Fisher, 1941) t test.

Adequate data for use in such a test were available for the three years 1939-41, only. Results are reported in Table 9, from which it can be seen that the differences were significant in all but one instance (a value of P of less than .05 is commonly considered to indicate significance).

The fact that all of the mean differences (Table 9) are positive, together with the generally low P values, indicates that average weight of chinooks decreases significantly as one proceeds up the river from the mouth, since all of the differences were formed by subtracting the weight for the upper of the two sections in question from that for the lower. Particularly notable are the consistently large differences between Zone 6 weights and Zone 3-5 weights.

In view of the significant differences found between zones in average weight, it would not seem appropriate to treat the entire commercial fishing area of the Columbia River as a unit in setting up a sampling system. An alternative procedure considered was to use the Zone 1 average weight as an index weight from which the weights for the other zones could be calculated. Because the validity of such a method depends on the constancy of interzonal weight ratios, a detailed study was made of these.

As a result of gaps in the data it was possible to cover only part of the fishing season in the study of interzonal ratios. For the ratio between Zone 2 and Zone 1 weights complete data were available covering the period June 5-July 30 of the years 1939-42; these ratios are given in Table 10. It can be seen that generally, although not without exception, the Zone 2 mean weights are smaller than the Zone 1. Particular attention is directed to the lowness of the 1940 and 1941 ratios as compared with those of 1939 and 1942. If the ratios for 1940 and 1942 are compared it is found that there is no overlap at all; the lowest 1942 ratio (.90) is considerably greater than the highest 1940 ratio (.78). The significance of these differences may be tested by means of the analysis of variance, with results as follows:

Source of variation	Degrees of Freedom	Sums of Squares	Mean Squares
Between years	3	3361	1120
Within years	28	762	27.2
Total	31	4123	----

The application to these results of Fisher's (1941) z test indicates that there is a significantly greater (P is less than .001) variation between years than within years.

The ratios of Zones 3-5 to Zone 1 were treated in a manner similar to the above, although more abundant data permitted the use of the somewhat longer period June 5- August 20. The individual ratios are given in Table 11. Again the 1940 and 1941 ratios prove to be low relative to the others, on the average. The analysis of variance yields the following results:

Source of variation	Degrees of Freedom	Sums of Squares	Mean Squares
Between years	3	8581	2860
Within years	40	4351	108.8
Total	43	12,932	--

As in the previous analysis the mean square between years is significantly greater than that within years; the z test gives a value of P less than .001.

The data for Zone 6 were not sufficiently extensive to permit analysis as above, so that conclusions must be based upon the study of ratios of Zone 2 and Zone 3-5 weights to Zone 1 weights. From the statistical tests made it may be inferred that the differences in ratios between fishing seasons are too great to permit the use of these interzonal ratios in calculating average weights. For instance, if the 1940 Zone 2 ratios were used in calculating 1942 Zone 2 weights from 1942 Zone 1 weights, the resulting calculated weights for 1942 would average 27 percent too low over the period of the analysis. Such a difference is too great to disregard, and might well lead to serious errors in the interpretation of final results.

Suggested Sampling Procedure.--Recapitulating the sampling analysis, it has been seen that the desired level of accuracy (95 per cent of the observations to fall within 10 percent of the true values) in sampling from a single river zone might be obtained by taking at least one sample aggregating at least 10 fish each week from each of three fish receiving stations in that zone, except that about three times as many samples should be taken during May. In this connection it should be emphasized that 10 fish per week is a minimum number; at least one full load should be weighed, which would ordinarily contain many more than 10 fish. For instance, referring to Table 5, from 10 to 623 fish per week were included in the single-station samples, with an average of 66. Furthermore, it has been shown that sampling should be done in each of the four river sections (Zone 1, Zone 2, Zones 3-5 and Zone 6) - that it is not feasible to use the weights from a single zone as an index to those from the others.

Because the average weights of fish received at certain stations tend to be consistently high or low (see stations "D" and "F" in Figure 3), care must be exercised in selecting the three stations for sampling from each zone so that they will be spaced as uniformly as

possible over the fishing area. This is particularly true of the spacing with respect to the up-river and down-river boundaries of the zones, since there is a tendency for the average weight to decrease as one proceeds up the river. Incidentally, it is because of these consistent differences in average weight between stations that sampling at three stations cannot be replaced by taking three times as many fish from one station.

The required amount of sampling could probably be accomplished by one man working along the river during the fishing season. A reduction in the amount of time required could be effected if it were possible to do the sampling at one of the large Astoria canneries which receive fish from all river zones. These canneries weigh all the loads of fish received, and it would only be necessary for the sampler to count the salmon in order to calculate the average weights. It would be necessary, however, to secure the cooperation of the cannery in having the boxes of fish from the various receiving stations labeled as to point of origin.

When the required averages from the four sections had been obtained it would only be necessary to weight them according to the amounts of fish landed in each section and week; this would automatically be accomplished if the catch poundages were converted to numbers by weeks for each zone. Use of the suggested sampling system would save considerable sampling effort; Table 7 shows, for instance, that adequate accuracy could be obtained by weighing only 1199 fish (three-station means) instead of 23,326 (all-station means). Thus in this instance about 95 percent of the effort could be saved.

SUMMARIZATION OF 1939-45 DATA

In the study of sampling the 1939-45 data were analyzed in considerable detail, but it becomes necessary due to gaps in the data to sacrifice some of this detail when summarizing the existing 1939-45 data for use in making poundage-to-numbers conversions. A considerable reduction in the number of hiatuses can be achieved if some of the zones and sections of the river are grouped to form larger sampling regions. In any event some such combination is necessary for the 1943-45 data, which are not as fully segregated by zones as the 1939-42 data.

Taking account of the above considerations, it seems that about the best that can be done is to lump all of the river sections into two regions. The lower of these, taking in the approximately 40 miles of the river from the mouth to Eaglecliff, Washington, includes Zones 1 and 2; the second, comprising the 140 miles of river from Eaglecliff to Celilo Falls, is made up of Zones 3-6. Although the second of the two regions includes a much larger river section than the first, fishing is much more scattered along the second, with the result that its average total catch is actually smaller than that of the first.

Average weights for the two river regions were combined by separately summing the total weights and the numbers of fish for the various sub-regions and then performing the division, giving a weighted average. This was done for the 1939-42 data previously presented in Tables 1-4, as well as the 1943-45 data collected by F. G. Bryant; the combined data are given in Tables 12-18.

The remaining step in completing the series of average weight data for the two river regions is to supply estimates of some sort to take the place of missing figures. Some of these estimates can be obtained by interpolation, which can be either (1) between weeks within a season or (2) between corresponding weeks of adjacent seasons. Season-to-season changes in average weight for each week and river region are shown graphically in Figures 4 and 5; by comparing these with Figure 1 it can be seen that season-to-season changes are much more regular than within-season changes. Such interpolations as were made were accordingly done by method (2) rather than method (1). Where gaps occurred at or near the ends of the period 1939-45, interpolations could not be made; in such cases the weight was taken to be the same as that of the nearest year for which a datum was available.

Where gaps in the data occurred during periods of heavy landings a special effort was made to produce accurate estimated weights. In these instances the missing weights were supplied by applying to the weight for the preceding year the ratio between the given and preceding year's weights for the preceding week. For instance, the weight for the week of August 14-20 in zones 1-2 was missing in 1943. The ratio "1943 weight over 1942 weight" for the week August 7-13 was 1.167. This ratio was applied to the 1942 August 14-20 weight of 24.3 pounds, giving 28.4 pounds as the estimated 1943 August 14-20 weight. Estimated weights are indicated in Tables 12-18 by figures in parentheses, and in Figures 4 and 5 by circles; inspection of the figures will indicate the method of estimation used in each instance.

Because of the relatively small amount of chinook salmon landed outside the period May 1 - October 1, no attempt was made to estimate individual weekly weights for the periods January 1 - April 30 and October 2 - December 31. Where landings occur during these parts of the year, and no observational data are available, it is proposed to use weights of 15 pounds for January 1 - April 30 and 20 pounds for October 2 - December 31. These approximations agree roughly with the few empirical data available, and also (for the latter period) with a similar approximation used by Rich (1942).

DISCUSSION

By use of the data in Tables 12-18, and of the pre-and post-season approximations of 15 and 20 pounds, it is possible to convert landings of chinook salmon from poundages to numbers of fish, by weeks and river regions. It is true that some of the data are not of as high a degree of accuracy as might be desired, but nevertheless their use in poundage conversions is certainly superior to the

employment of a single overall conversion factor. One such factor much used in the past has been 22 pounds. A single instance will serve to illustrate the degree of error which could be occasioned by the utilization of this factor. The actual average weight in zones 1-2 for the week August 21-27 of 1939, as determined from 10,156 fish landed at five different stations, was 25.9 pounds (Table 12). Use of the figure of 22 pounds during this week would result in an error of 15 percent, enough to seriously affect results, when the extremely heavy landings made during this part of the season are considered.

In general the sampling of average weights has been heaviest during the periods of heaviest landings. This is favorable to the successful use of the averages in making poundage-to-numbers conversions of total catch, since the most accurate data will be accorded the greatest weight in the final results.

Although the past data, with their admitted limitations, will have to be used for catches made in the past, it is desirable to have more accurate information for future use. The additional accuracy can be obtained by use of the improved sampling system described in the section "Suggested sampling procedure". If this is adopted the amount of error can be kept within the desired limits at all times.

LITERATURE CITED

Chapman, Wilbert M.
1940 The average weight of food fish taken by the commercial fishery in the Columbia River. State of Washington Department of Fish., Biol. Rept. No. 39A, 31 pp. illus.

Fisher, R. A.
1941 Statistical methods for research workers (Eighth Ed.) xiii+344 pp., illus., New York.

Rich, Willis H.
1940 Seasonal variations in weight of Columbia River chinook salmon, Copeia, 1940, No.1, pp. 34-43, illus.

1942 The salmon runs of the Columbia River in 1938, Fishery Bull. U. S. Fish and Wildlife Service, Vol. 50, No. 37, pp. 103-147, illus.

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TABLE I. Average weights in pounds, number of stations reporting and total number of fish counted in each of four sections of the Columbia River in 1939, by weeks.

Week Ending		Zone 1			Zone 2			Zone 3-5			Zone-6		
		No.of Sta's	Fish	Mean Weight	No. of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight
May	7	1	224	17.1	.	..	....	.	..	....	.	..	....
	14	1	128	19.2	.	..	....	.	..	....	.	..	....
	21	2	30	19.1	.	..	....	.	..	....	.	..	....
	28	5	195	19.4	1	34	19.4	1	16	16.0	1	94	14.2
June	4	6	770	22.2	1	88	20.0	1	35	18.2	1	50	11.2
	11	6	782	23.5	1	143	20.9	2	52	18.4	1	20	14.1
	18	7	1,101	25.0	2	607	22.9	2	109	21.4	1	9	14.2
	25	7	2,306	26.6	2	721	25.0	2	100	24.7	1	5	7.0
July	2	7	1,733	29.2	2	902	27.5	2	227	25.2	1	2	21.0
	9	7	2,186	30.2	2	894	30.8	2	253	27.5	.	..	....
	16	7	2,848	30.2	2	694	27.2	1	444	27.7	.	..	....
	23	7	1,906	29.5	2	349	27.7	1	136	27.5	.	..	....
	30	7	4,080	29.0	2	383	28.0	1	114	24.9	1	20	26.3
August	6	7	4,723	28.5	1	29	24.0	1	74	23.4	.	..	....
	13	6	9,838	27.9	.	..	....	2	141	23.3	1	69	17.3
	20	6	6,992	26.7	.	..	....	2	408	22.1	1	108	24.6
	27	5	10,156	25.9	.	..	....	2	317	16.5	.	...	....

TABLE 2. Average weights in pounds, numbers of stations reporting and total number of fish counted in each of four sections of the Columbia River in 1940, by weeks.

Week Ending		Zone 1			Zone 2			Zone 3-5			Zone-6		
		No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight
May	7	2	15	19.7	.	...	....	2	6,585	14.8	2	4,218	11.1
	14	2	17	15.2	.	...	....	2	488	15.7	2	2,648	12.2
	21	1	10	16.0	.	...	....	2	920	13.1	2	1,152	13.5
	28	1	5	11.8	.	...	....	2	669	13.4	2	761	14.3
June	4	3	215	22.7	.	...	....				2	391	12.2
	11	8	355	24.7	3	53	15.2	2	740	23.0	2	206	13.6
	18	9	488	25.5	4	205	20.0	2	2,112	19.9	2	172	11.9
	25	8	1,376	26.7	6	261	19.8	2	2,763	21.3	2	42	10.4
July	2	9	1,301	27.8	5	374	20.5	2	5,355	20.3	1	12	8.9
	9	8	1,476	28.6	4	161	18.7	3	3,649	18.9	1	12	8.5
	16	9	1,563	29.0	5	268	18.9	3	5,322	17.2	1	18	9.3
	23	9	1,562	27.0	7	266	20.5	3	4,273	18.3			
	30	12	2,645	27.8	6	206	20.7	2	3,080	19.7	1	64	12.1
August	6	9	7,189	26.6	1	8	24.1	3	3,871	17.8	1	161	7.5
	13	9	12,422	25.0	1	21	14.4	1	316	10.2	.	...	...
	20	8	12,341	24.3	.		....	2	5,452	15.8	.	...	...
	27	6	5,109	24.1	.		....	.	.....	....	.	...	...
Sept.	3		.....	....	.	...	....	.	.....	....	.	...	...
	10		.....	....	.	...	....	.	.....	....	.	...	...
	17	1	69	26.9	.	...	....	.	.....	....	.	...	...
	24	1	55	17.2	.	...	....	.	.....	....	.	...	...

TABLE 3. Average weights in pounds, numbers of stations reporting and total number of fish counted in each of four sections of the Columbia River in 1941, by weeks.

Week Ending		Zone 1			Zone 2			Zone 3-5			Zone 6		
		No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight
May	7	2	293	15.0	..	...	....	.	...	....	.	..	....
	14	2	242	15.4	..	...	....	.	...	....	.	..	....
	21	2	124	16.7	..	...	....	.	...	....	.	..	....
	28	2	115	17.6	..	...	....	.	...	....	.	..	....
								.	...	....	.	..	....
June	4	2	151	20.3	..	...	....	.	...	....	.	..	....
	11	7	334	22.6	7	116	20.9	1	28	16.5	.	..	....
	18	10	611	22.4	9	184	20.2	3	149	18.4	1	66	13.0
	25	11	600	22.1	10	345	19.5	4	222	18.5	1	27	13.1
July	2	11	653	21.0	9	225	20.5	4	289	20.0	1	9	13.6
	9	7	297	21.2	8	327	19.0	2	105	18.4	.	.	....
	16	9	296	23.6	6	109	18.3	3	113	19.1	.	.	....
	23	10	319	25.7	5	66	21.0	4	159	17.9	1	50	13.3
	30	12	1,074	26.0	6	162	23.5	4	256	17.6	1	19	14.6
August	6	11	2,290	26.3	8	272	23.3	4	176	17.8	1	25	18.9
	13	11	4,493	26.1	5	232	23.5	3	141	20.2	.	..	....
	20	8	3,894	25.5	6	603	23.3	2	76	16.2	.	..	....
	27	5	4,829	25.0	3	592	22.3	1	8	16.6	.	..	....
Sept.	3	..	.....	....	.	...	....	.	...	....	.	..	....
	10	..	.....	....	.	...	....	.	...	....	.	..	....
	17	3	2,642	22.1	1	924	23.5	.	...	....	.	..	....
	24	5	2,603	20.3	1	111	21.5	.	...	....	.	..	....
Oct.	1	3	705	20.3	1	102	22.2	.	...	....	.	..	....
	8	2	88	19.2	2	29	20.7	.	...	....	.	..	....
	15	1	23	22.0	2	21	23.5	.	...	....	.	..	....
	22	1	31	21.8	1	6	20.3	.	...	....	.	..	....
	29	..	.....	....	1	1	15.0	.	...	....	.	..	....

TABLE 4. Average weights in pounds, number of stations reporting and total number of fish counted in each of four sections of the Columbia River in 1942, by weeks.

Week Ending	Zone 1			Zone 2			Zone 3-5			Zone 6		
	No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight	No.of Sta's	Fish	Mean Weight
May 7	10	1,515	16.8	1	11	17.7	.	...	....	.	...	....
14	8	497	16.3	3	189	15.1	1	100	16.2	.	...	....
21	10	358	18.4	6	174	16.6	.	...	....	.	...	....
28	10	422	19.6	10	281	18.2	1	31	16.4	.	...	....
June 4	11	901	22.3	9	373	21.1	1	47	17.5	.	...	....
11	12	1,097	23.7	11	782	24.5	1	289	21.2	.	...	....
18	13	1,624	24.2	13	845	24.3	2	121	25.2	.	...	....
25	14	2,043	24.0	13	1,202	23.5	2	232	24.0	.	...	....
July 2	14	2,195	23.1	14	1,503	23.4	2	329	23.3	.	...	....
9	13	1,244	22.2	13	1,324	21.8	3	598	21.4	.	...	....
16	14	1,332	25.2	12	1,284	22.8	3	530	21.3	.	...	....
23	14	1,031	25.0	12	1,158	24.7	3	415	24.8	.	...	....
30	14	2,484	26.4	12	1,298	24.5	2	298	23.1	.	...	....
August 6	13	3,711	26.2	8	1,433	24.6	2	394	22.8	.	...	....
13	13	7,852	25.6	8	1,703	24.0	2	320	22.1	.	...	....
20	13	11,765	24.8	9	2,650	21.9	2	504	21.9	.	...	....
27	11	14,872	23.9	7	4,554	20.5	2	385	20.1	.	...	....
Sept. 3	..	.....	....	.	.....	....	.	...	....	.	...	....
10	..	.....	....	.	.....	....	.	...	....	.	...	....
17	7	12,567	23.2	4	1,749	22.3	1	964	20.2	1	126	20.2
24	7	4,348	22.0	3	992	21.0	1	761	18.9	.	...	....
Oct. 1	6	741	20.8	3	530	20.4	1	150	19.2	.	...	....
8	4	19	20.8	4	188	22.6	.	...	....	.	...	....
15	2	4	25.8	4	131	23.9	.	...	....	.	...	....
22	2	14	26.5	3	44	28.1	.	...	....	.	...	....
29	3	15	32.1	3	42	27.9	.	...	....	.	...	....
Nov. 5	2	5	25.2	3	20	24.3	.	...	....	.	...	....
12	3	5	30.4	2	4	24.5	.	...	....	.	...	....
19	..	.....	....	.	.....	.....	.	...	....	.	...	....
26	1	2	26.5	..	.....	....	.	...	....	.	...	....

TABLE 5. Mean weights in pounds of chinook salmon landed at various receiving stations in Zone 1 of the Columbia River, 1942. Single-station means are based on one or more samples aggregating at least 10 fish; all-station means are based on all available samples from the stations covered in the study.

Week Ending	Station A		Station B		Station C		3 Stations 1/		All-stations 2/	
	No.of fish	Mean Wt.	No.of fish	Mean Wt.	No. of fish	Mean Wt.	No.of fish	Mean Wt.	No.of fish	Mean Wt.
May 7	87	16.4	52	17.0	47	10.1	186	14.5	1515	16.8
14	12	20.3	25	17.2	33	15.2	70	17.6	497	16.3
21	12	18.5	14	15.5	13	18.0	39	17.7	358	18.4
28	11	17.0	10	17.7	14	16.8	35	17.2	422	19.6
June 4	11	19.2	24	20.7	18	21.2	53	20.4	901	22.3
11	38	20.6	16	24.2	26	22.9	80	22.6	1097	23.7
18	49	23.7	15	24.5	23	23.8	87	24.0	1624	24.2
25	20	21.4	20	24.0	17	25.8	57	23.4	2043	24.0
July 2	38	20.5	35	21.4	22	26.2	95	22.7	2195	23.1
9	14	16.7	11	22.2	48	23.1	73	20.7	1244	22.2
16	24	23.4	25	22.4	15	27.3	64	24.4	1332	25.2
23	16	26.4	25	24.2	10	26.3	51	25.6	1031	25.0
30	14	25.5	13	25.7	34	26.2	61	25.8	2484	26.4
Aug. 6	53	24.4	28	25.0	109	26.9	190	25.4	3711	26.2
13	41	26.7	65	27.1	50	26.8	156	26.9	7852	25.6
20	96	26.4	38	28.2	67	26.1	201	26.9	11765	24.8
27	57	24.7	617	17.6	88	24.7	762	22.3	14872	23.9
Sept. 3	(3/)	....	...	....	..	....	...	....	.....	....
10	(3/)	....	...	....	..	....	...	....	.....	....
17	623	22.5	103	24.4	71	25.8	797	24.2	12567	23.2
24	264	23.1	141	21.0	405	24.2	810	22.8	4348	22.0
Oct. 1	26	19.8	28	20.7	32	21.0	86	20.5	741	20.8
TOTALS	1,506	....	1,305	....	1,142	....	3,953	....	72,599	....

1/ Mean weight is simple average of the three single-station means.

2/ Mean weight is average weight of all fish weighed.

3/ Closed season.

TABLE 6. Weighted means,[1] their root-mean-square errors, and the 95 percent fiducial limits for single-station and three-station weekly average weights of chinook salmon during certain parts of the 1942 fishing season in Zone 1.

Period and Item:	Station A	Station B	Station C	Mean of 3 Sta's.
May 1-28:				
Weighted mean weight, pounds	17.5	17.0	13.2	15.9
Root-mean-square error, pounds	1.0	.7	2.5	1.0
95% fiducial limits, pounds	±2.9	±1.9	±6.9	±2.8
95% fiducial limits, % of mean	±17	±11	±52	±18
May 29 - July 30:				
Weighted mean weight, pounds	22.5	23.5	25.3	23.7
Root-mean-square error, pounds	.8	.4	.6	.3
95% fiducial limits, pounds	±1.9	±1.0	±1.2	±.6
95% fiducial limits, % of mean	±8	±4	±5	±3
July 31 - October 1:				
Weighted mean weight, pounds	24.2	22.7	25.4	24.1
Root-mean-square error, pounds	.4	1.5	.7	.6
95% fiducial limits, pounds	±.9	±3.6	±1.6	±1.3
95% fiducial limits, % of means	± 4	± 16	± 6	±5
Season May 1 - October 1:				
Weighted mean weight, pounds	24.0	22.6	25.2	24.0
Root-mean-square error, pounds	.3	.9	.4	.3
95% fiducial limits, pounds	±.6	±1.8	±.9	±.7
95% fiducial limits, % of mean	±2	±8	±4	±3

[1] Weighted by total catch during each week.

TABLE 7. Mean weights in pounds of chinook salmon landed at various receiving stations in Zone 2 of the Columbia River, 1942. Single-station means are based on one or more samples aggregating at least 10 fish; all-station means are based on all available samples from the stations covered.

Week Ending	Station D		Station E		Station F		3 Stations 1/		All Stations 2/	
	No. of fish	Mean Wt.	No. of fish	Mean Wt.	No. of fish	Mean Wt.	No. of fish	Mean Wt.	No. of fish	Mean Wt.
June 11	14	19.6	15	23.9	14	36.1	43	26.5	782	24.5
18	10	17.6	14	26.9	11	28.5	35	24.3	845	24.3
25	...	....	47	32.6	25	25.3	...	....	1202	23.5
July 2	18	19.3	18	19.6	13	24.4	49	21.1	1503	23.4
9	19	16.9	23	21.2	17	26.1	59	21.4	1324	21.8
16	15	14.7	10	19.9	24	30.3	49	21.6	1284	22.8
23	17	16.9	23	24.3	26	23.7	66	21.6	1158	24.7
30	12	23.0	25	25.0	33	32.8	70	26.9	1298	24.5
Aug. 6	31	21.7	15	26.6	17	29.8	63	26.0	1433	24.6
13	20	20.6	17	24.5	27	28.2	64	24.4	1703	24.0
20	15	19.4	41	22.0	89	23.2	145	21.5	2650	21.9
27	51	19.3	22	20.4	92	27.4	165	22.4	4554	20.5
Sept. 3	(3/)	....	...	....	..	....	...	....	....	....
10	(3/)	....	...	....	..	....	...	....	....	....
17	132	23.8	...	....	436	24.9	...	....	1749	22.3
24	41	18.1	111	19.9	80	25.2	232	21.1	992	21.0
Oct. 1	24	20.0	23	16.3	19	23.6	66	20.0	530	20.4
8	18	19.9	14	25.9	18	26.3	50	24.0	188	22.6
15	17	23.0	13	20.5	13	23.4	43	22.3	131	23.9
TOTALS	454	....	431	....	954	....	1199	....	23,326	....

1/ Mean weight is simple average of the three single-station means.

2/ Mean weight is average weight of all fish weighed.

3/ Closed season

TABLE 8. Weighted means, [1] their root-mean-square errors, and the 95 percent fiducial limits for single-station and three-station weekly average weights of chinook salmon during certain parts of the 1942 fishing season in Zone 2.

Period and Item:	Station D	Station E	Station F	Mean of 3 stations
June 5 - July 30				
Weighted mean weight, pounds	18.4	24.1	28.0	23.1
Root-mean-square error, pounds	2.3	1.4	2.0	.8
95% fiducial limits, pounds	±5.4	±3.2	±4.7	±1.8
95% fiducial limits, % of mean	±29	±13	±17	±8
July 31 - October 15				
Weighted mean weight, pounds	21.1	20.8	25.4	22.0
Root-mean-square error, pounds	.7	.7	1.3	.4
95% fiducial limits, pounds	±1.6	±1.6	±3.0	±.9
95% fiducial limits, % of mean	±8	±8	±12	±4
Season June 5 - October 15				
Weighted mean weight, pounds	20.7	21.5	25.8	22.2
Root-mean-square error, pounds	.7	.6	1.0	.3
95% fiducial limits, pounds	±1.5	±1.3	±2.2	±.7
95% fiducial limits, % of mean	±7	±6	±9	±3

[1] Weighted by total catch in each week.

TABLE 9. Data relative to tests of significance of differences between average weights of Columbia River chinook salmon for corresponding weeks of adjacent river sections.

Fishing season and comparison made:	No. of weeks	Mean diff., lb.	t	P
1939:				
Zone 1 with Zone 2	11	1.81	4.31	<.01
Zone 2 with Zones 3-5	11	1.68	4.08	<.01
Zones 3-5 with Zone 6	9	4.92	2.50	.04
1940:				
Zone 1 with Zone 2	10	7.59	9.57	<.01
Zone 2 with Zones 3-5	10	.62	.53	.6
Zones 3-5 with Zone 6	12	8.18	6.57	<.01
1941:				
Zone 1 with Zone 2	18	1.46	2.86	.01
Zone 2 with Zones 3-5	12	3.18	4.30	<.01
Zones 3-5 with Zone 6	6	3.95	3.56	.02

TABLE 10. Ratios "mean weight, Zone 2 over mean weight, Zone 1" for Columbia River chinook salmon, by weeks.

Week Ending	1939	1940	1941	1942
June 11	.89	.62	.92	1.03
18	.92	.78	.90	1.00
25	.94	.74	.88	.98
July 2	.94	.74	.98	1.01
9	1.02	.65	.90	.98
16	.90	.65	.78	.90
23	.94	.76	.82	.99
30	.97	.74	.90	.93

TABLE 11. Ratios "mean weight, Zones 3-5, over mean weight, Zone 1" for Columbia River chinook salmon, by weeks.

Week Ending	1939	1940	1941	1942
June 11	.83	1.01	.81	.95
18	.91	.81	.81	1.06
25	.99	.84	.83	.99
July 2	.95	.76	.90	.97
9	.94	.68	.88	.93
16	.92	.60	.90	.96
23	.91	.63	.76	.98
30	.84	.73	.68	.92
August 6	.81	.64	.68	.86
13	.82	.38	.77	.84
20	.79	.63	.62	.86

TABLE 12. Average weights in pounds, number of stations reporting and total number of fish counted in each of two regions of the Columbia River, 1939. Weights in parentheses were estimated as explained in text.

Week Ending	Zones 1 - 2			Zones 3 - 6		
	No. of		Mean	No. of		Mean
	Sta's	Fish	Weight	Sta's	Fish	Weight
May 7	1	224	17.1	.	...	(13.4)
14	1	128	19.2	.	...	(12.7)
21	2	30	19.1	.	...	(13.3)
28	6	229	19.4	2	110	14.5
June 4	7	858	22.0	2	85	14.1
11	7	925	23.1	3	72	17.2
18	9	1708	24.3	3	118	20.9
25	9	3027	26.2	3	105	23.9
July 2	9	2635	28.6	3	229	25.2
9	9	3080	30.4	2	253	27.5
16	9	3542	29.6	1	444	27.7
23	9	2255	29.2	1	136	27.5
30	9	4463	28.9	2	134	25.1
Aug. 6	8	4752	28.5	1	74	23.4
13	6	9838	27.9	3	210	21.3
20	6	6992	26.7	3	516	22.6
27	5	10156	25.9	2	317	16.5
Sept. 3	.	.....	(1/)	.	...	(1/)
10	.	.....	(1/)	.	...	(1/)
17	.	.....	(26.9)	.	...	(20.2)
24	.	.....	(17.2)	.	...	(18.9)
Oct. 1	.	.....	(20.5)	.	...	(19.2)

1/ Closed season.

TABLE 13. Average weights in pounds, numbers of stations reporting and total number of fish counted in each of two regions of the Columbia River, 1940. Weights in parentheses were estimated as explained in text.

Week Ending	Zones 1 - 2			Zones 3 - 6		
	No. of		Mean	No. of		Mean
	Sta's	Fish	Weight	Sta's	Fish	Weight
May 7	2	15	19.7	4	10803	13.4
14	2	17	15.2	4	3136	12.7
21	1	10	16.0	4	2072	13.3
28	1	5	11.8	4	1430	13.9
June 4	3	215	22.7	2	391	12.2
11	11	408	23.5	4	946	13.9
18	13	693	23.9	4	2284	19.3
25	14	1637	25.6	4	2805	21.1
July 2	14	1675	26.2	3	5367	20.3
9	12	1637	27.6	4	3661	18.9
16	14	1831	27.5	4	5340	17.2
23	16	1828	26.1	3	4273	18.3
30	18	2851	27.3	3	3144	19.5
Aug. 6	10	7197	26.6	4	4032	17.4
13	10	12443	25.0	1	316	10.2
20	8	12341	24.3	2	5452	15.8
27	6	5109	24.1	.	....	(16.5)
Sept. 3	..	....	(1/)	.	....	(1/)
10	..	....	(1/)	.	....	(1/)
17	1	69	26.9	.	....	(20.2)
24	1	55	17.2	.	....	(18.9)
Oct. 1	..	..	(20.5)	.	....	(19.2)

1/ Closed season.

TABLE 14. Average weights in pounds, number of stations reporting and total number of fish counted in each of two regions of the Columbia River, 1941. Weights in parentheses were estimated as explained in text.

Week Ending	Zones 1 - 2			Zones 3 - 6		
	No.of			No.of		
	Sta's	Fish	Mean Weight	Sta's	Fish	Mean Weight
May 7	2	293	15.0	.	...	(14.2)
14	2	242	15.4	.	...	(14.5)
21	2	124	16.7	.	...	(13.3)
28	2	115	17.6	.	...	(15.1)
June 4	2	151	20.3	.	...	(14.8)
11	14	450	22.2	1	28	16.5
18	19	795	21.9	4	215	16.7
25	21	945	21.2	5	249	17.9
July 2	20	878	20.9	5	298	19.8
9	15	624	20.0	2	105	18.4
16	15	405	22.2	3	113	19.1
23	15	385	24.9	5	209	16.8
30	18	1236	25.7	5	275	17.4
Aug. 6	19	2562	26.0	5	201	17.9
13	16	4725	26.0	3	141	20.2
20	14	4497	25.2	2	76	16.2
27	8	5421	24.7	1	8	16.6
Sept. 3	..	....	(1/)	.	...	(1/)
10	..	....	(1/)	.	...	(1/)
17	4	3566	22.5	.	...	(20.2)
24	6	2714	20.3	.	...	(18.9)
Oct. 1	4	807	20.5	.	...	(19.2)
8	4	117	19.6	.	...	....
15	3	44	22.7	.	...	....
22	2	37	21.6	.	...	....
29	1	1	15.0	.	...	....

1/ Closed season.

TABLE 15. Average weights in pounds, number of stations reporting and total number of fish counted in each of two regions of the Columbia River, 1942. Weights in parentheses were estimated as explained in text.

Week Ending	Zones 1 - 2			Zones 3 - 6		
	No.of			No.of		
	Sta's	Fish	Mean Weight	Sta's	Fish	Mean Weight
May 7	11	1526	16.8	.	....	(15.0)
14	11	686	16.0	1	100	16.2
21	16	532	17.8	.	....	(13.2)
28	20	703	19.0	1	31	16.4
June 4	20	1274	21.9	1	47	17.5
11	23	1879	24.0	1	289	21.2
18	26	2469	24.2	2	121	25.2
25	27	3245	23.8	2	232	24.0
July 2	28	3698	23.2	2	329	23.3
9	26	2568	22.0	3	598	21.4
16	26	2616	24.0	3	530	21.3
23	26	2189	24.8	3	415	24.8
30	26	3782	25.7	2	298	23.1
Aug. 6	21	5144	25.8	2	394	22.8
13	21	9555	25.3	2	320	22.1
20	22	14415	24.3	2	504	21.9
27	18	19426	23.1	2	385	20.1
Sept. 3	..	.....	(1/)	.	....	(1/)
10	..	.....	(1/)	.	....	(1/)
17	11	14316	23.1	2	1090	20.2
24	10	5340	21.8	1	761	18.9
Oct. 1	9	1271	20.6	1	150	19.2
8	8	207	22.4	.	....	....
15	6	135	24.0	.	....	....
22	5	58	27.7	.	....	....
29	6	57	29.0	.	....	....
Nov. 5	5	25	24.5	.	....	....
12	5	9	27.8	.	....	....
19	..	.....	....	.	....	....
26	1	2	26.5	.	....	....

1/ Closed season

TABLE 16. Average weights in pounds and total number of fish counted in each of two regions of the Columbia River in 1943, by weeks. Weights in parentheses were estimated as explained in text.

Week Ending	Zones 1 - 2		Zones 3 - 6	
	No. of Fish	Mean Weight	No. of Fish	Mean Weight
May 7	...	(16.5)	....	(15.8)
14	...	(15.3)	....	(15.9)
21	...	(17.9)	....	(13.2)
28	...	(1/)	....	(1/)
June 4	...	(1/)	....	(1/)
11	...	(22.0)	....	(17.7)
18	...	(23.9)	93	2/ 21.0
25	...	(25.1)	50	2/ 16.6
July 2	25	2/ 27.0	....	(24.1)
9	...	(25.0)	....	(25.6)
16	50	2/ 27.9	....	(19.8)
23	25	2/ 29.9	....	(24.2)
30	46	2/ 29.3	....	(23.0)
Aug. 6	50	2/ 29.6	....	(22.1)
13	100	2/ 29.6	....	(21.6)
20	...	(28.4)	....	(21.0)
27	25	2/ 28.8	....	(18.1)
Sept. 3	...	(1/)	....	(1/)
10	...	(1/)	....	(1/)
17	...	(21.2)	1259	16.1
24	...	(18.4)	....	(17.5)
Oct. 1	...	(19.3)	....	(18.5)

1/ Closed season

2/ Obtained from length samples by means of a weight-length relationship based on 133 fish weighed and measured at Astoria in 1945.

TABLE 17. Average weights in pounds and total number of fish counted in each of two regions of the Columbia River, 1944, by weeks. Weights in parentheses were estimated as explained in text.

Week Ending	Zones 1 - 2		Zones 3 - 6	
	No. of fish	Mean Weight	No. of fish	Mean Weight
May 7	130	16.3	136	16.6
14	203	14.7	88	15.5
21	73	18.0	73	13.2
28	....	(1/)	...	(1/)
June 4	....	(1/)	...	(1/)
11	....	(20.0)	...	(17.5)
18	344	23.7	142	20.8
25	795	26.4	89	21.9
July 2	1712	27.0	190	24.8
9	398	28.1	24	29.7
16	90	28.3	...	(18.3)
23	200	24.8	262	23.6
30	416	24.7	103	22.8
Aug. 6	558	24.8	...	(21.4)
13	1499	24.5	141	21.1
20	733	23.6	...	(20.0)
27	852	21.0	...	(16.1)
Sept. 3	....	(1/)	...	(1/)
10	....	(1/)	...	(1/)
17	....	(19.3)	100	21.8
24	81	15.0	...	(16.1)
Oct. 1	20	18.0	50	17.9
8	....	....	...	....
15	19	18.6	...	....

1/ Closed season.

TABLE 18. Average weights in pounds and total number of fish counted in each of two regions of the Columbia River, 1945, by weeks. Weights in parentheses were estimated as explained in text.

Week Ending	Zones 1 - 2		Zones 3 - 6	
	No. of Fish	Mean Weight	No. of Fish	Mean Weight
Mar. 26	585	18.4	140	16.7
Apr. 2	135	18.2	70	15.5
9	....	....	....	....
16	....	....	....	....
23	....	....	....	....
30	....	....	....	....
May 7	325	15.2	300	13.5
14	420	15.1	40	14.6
21	217	14.8	....	(13.2)
28	...	(1/)	....	(1/)
June 4	...	(1/)	....	(1/)
11	104	18.0	....	(6.1)
18	588	11.5	190	7.3
25	1110	11.1	83	9.4
July 2	774	14.0	55	14.3
9	1202	15.7	136	15.6
16	179	21.2	317	16.8
23	1035	20.7	378	16.8
30	1267	22.4	365	19.5
Aug. 6	5609	25.4	298	20.7
13	5965	21.9	532	22.6
20	7816	22.6	186	19.1
27	2744	21.0	502	14.1
Sept. 3	....	(1/)	....	(1/)
10	....	(1/)	....	(1/)
17	5434	17.4	3209	16.4
24	864	12.4	236	14.7
Oct. 1	....	(18.0)	....	(17.9)

1/ Closed season

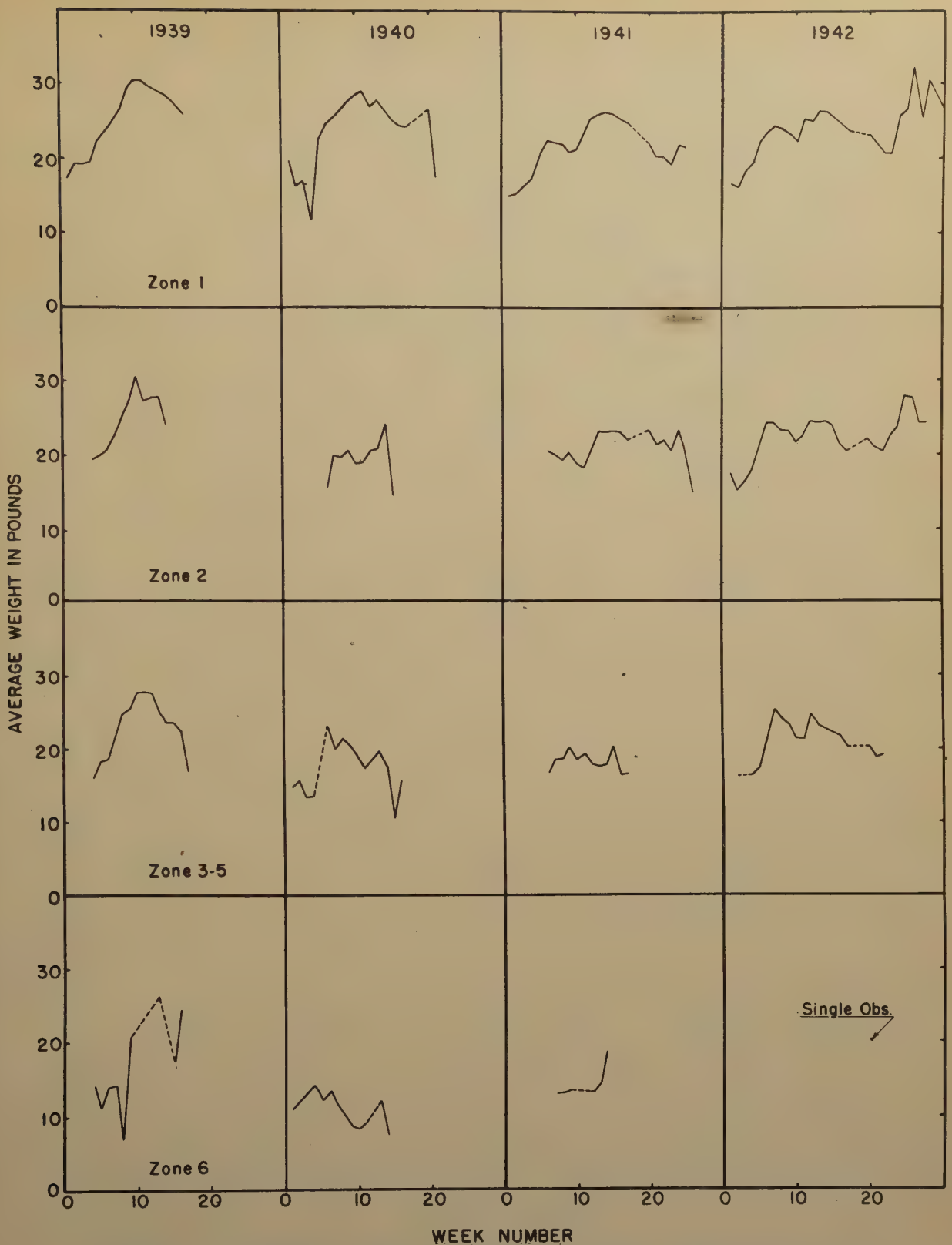

FIGURE 1. Average weights of Columbia River chinook salmon, by seasons, zones and weeks. Ends of weeks corresponding to week numbers are: 1-4: May 7, 14, 21, 28; 5-8: June 4, 11, 18, 25; 9-13: July 2, 9, 16, 23, 30; 14-17: August 6, 13, 20, 27; 18-21: September 3, 10, 17, 24; 22-26: October 1, 8, 15, 22, 29; 27-30: November 5. 12, 19, 26; 31-35: December 3, 10, 17, 24, 31.

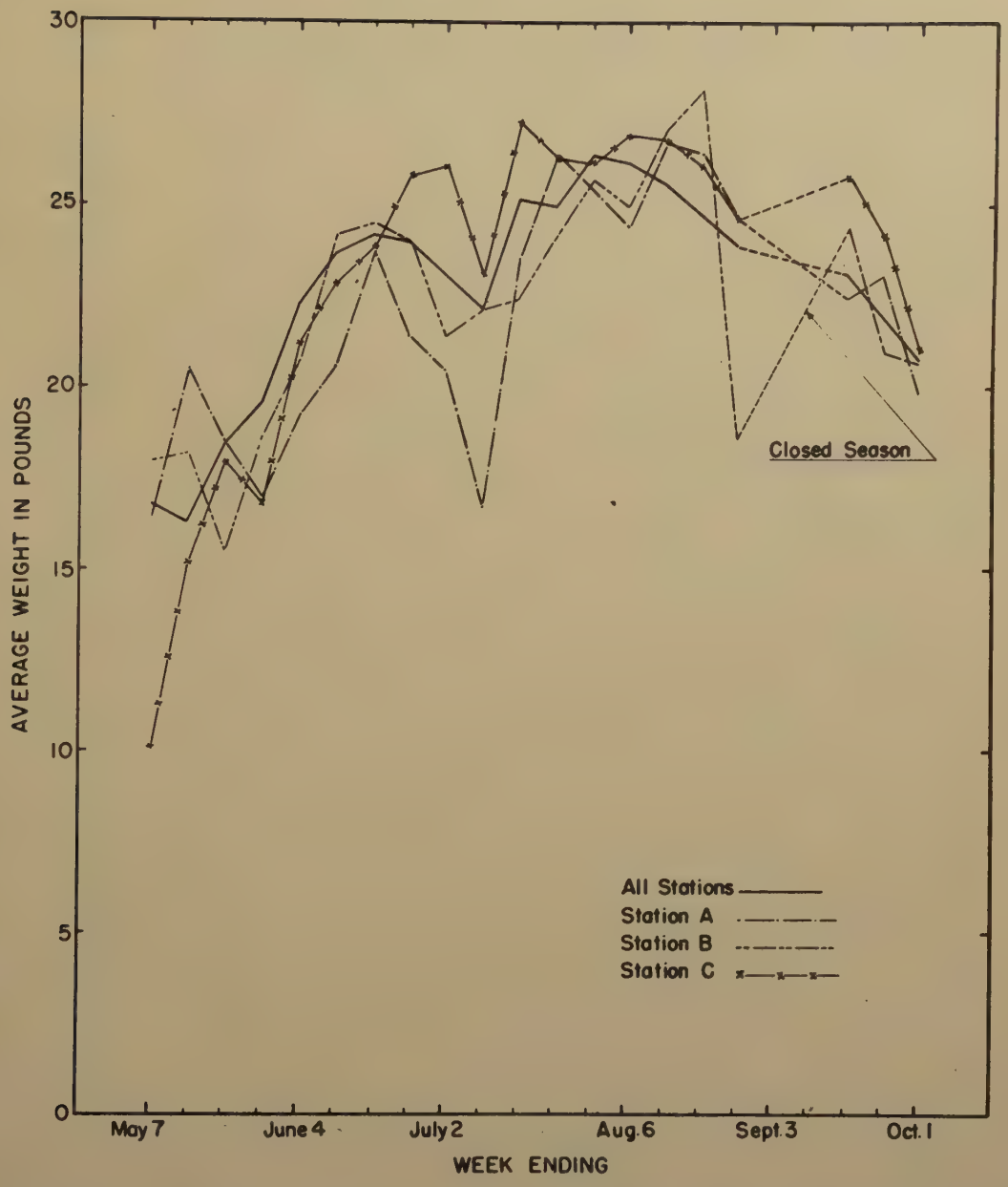

FIGURE 2. Average weights of Columbia River chinook salmon in Zone 1, 1942. Single-station averages are based on one or more samples aggregating at least 10 fish; all-station averages are based on all available samples from the stations covered in the study.

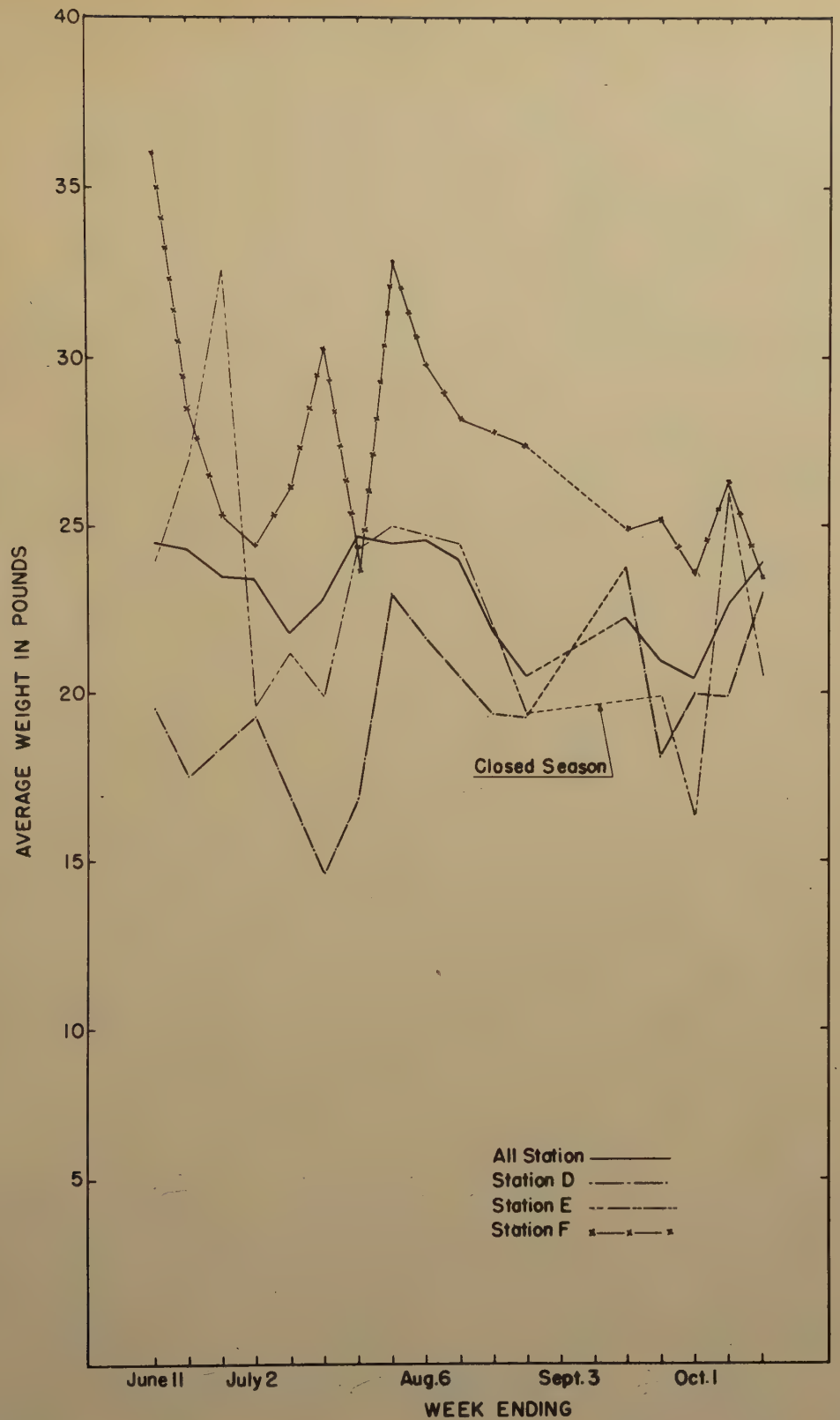

FIGURE 3. Average weights of Columbia River chinook salmon in Zone 2, 1942. Single-station averages are based on one or more samples aggregating at least 10 fish; all-station averages are based on all available samples from the stations covered in the study.

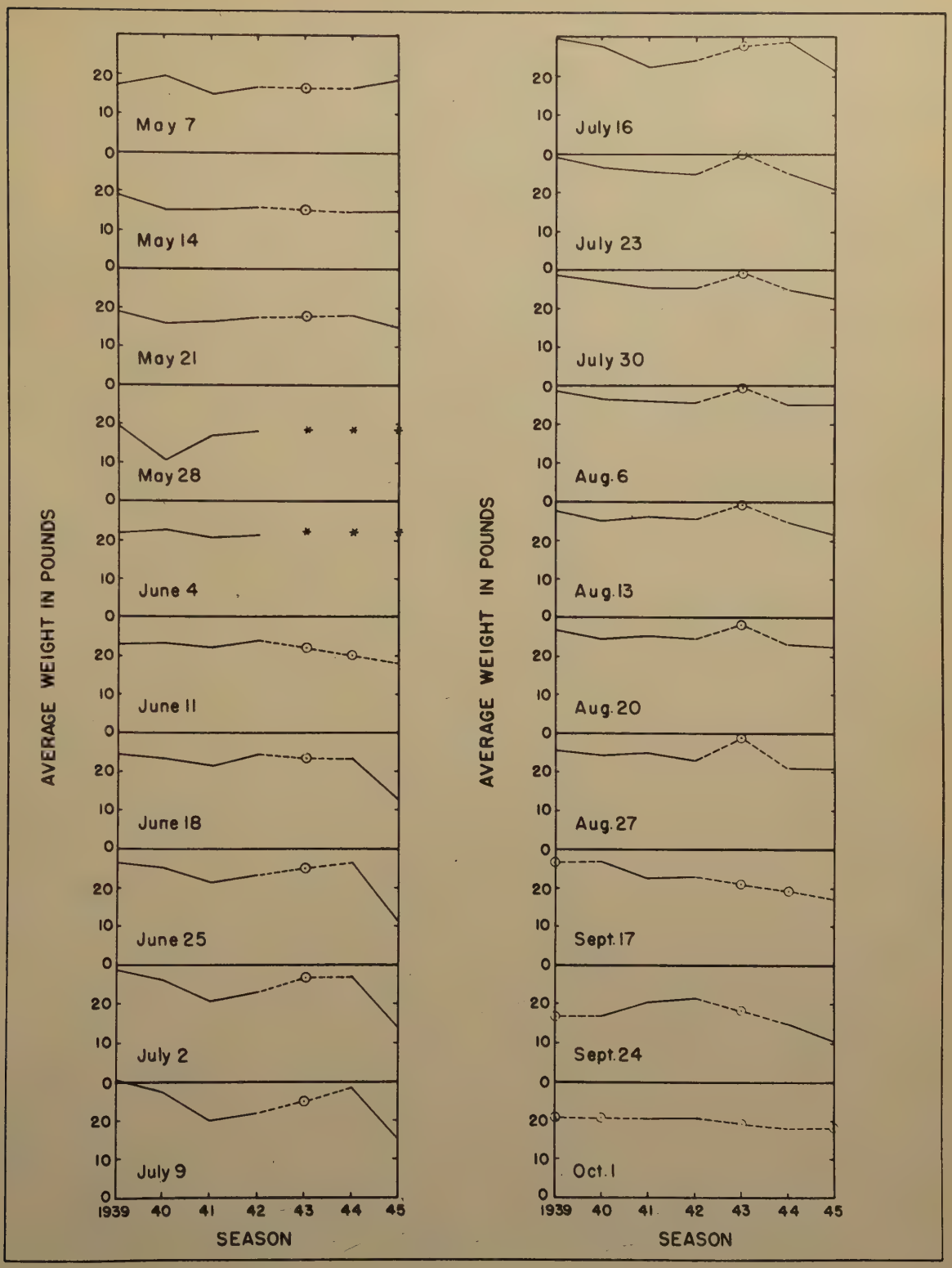

FIGURE 4. Average weights of Columbia River chinook salmon, Zone 1-2, by seasons for individual weeks ending on indicated dates. Circles represent estimated weights; asterisks indicate closed season.

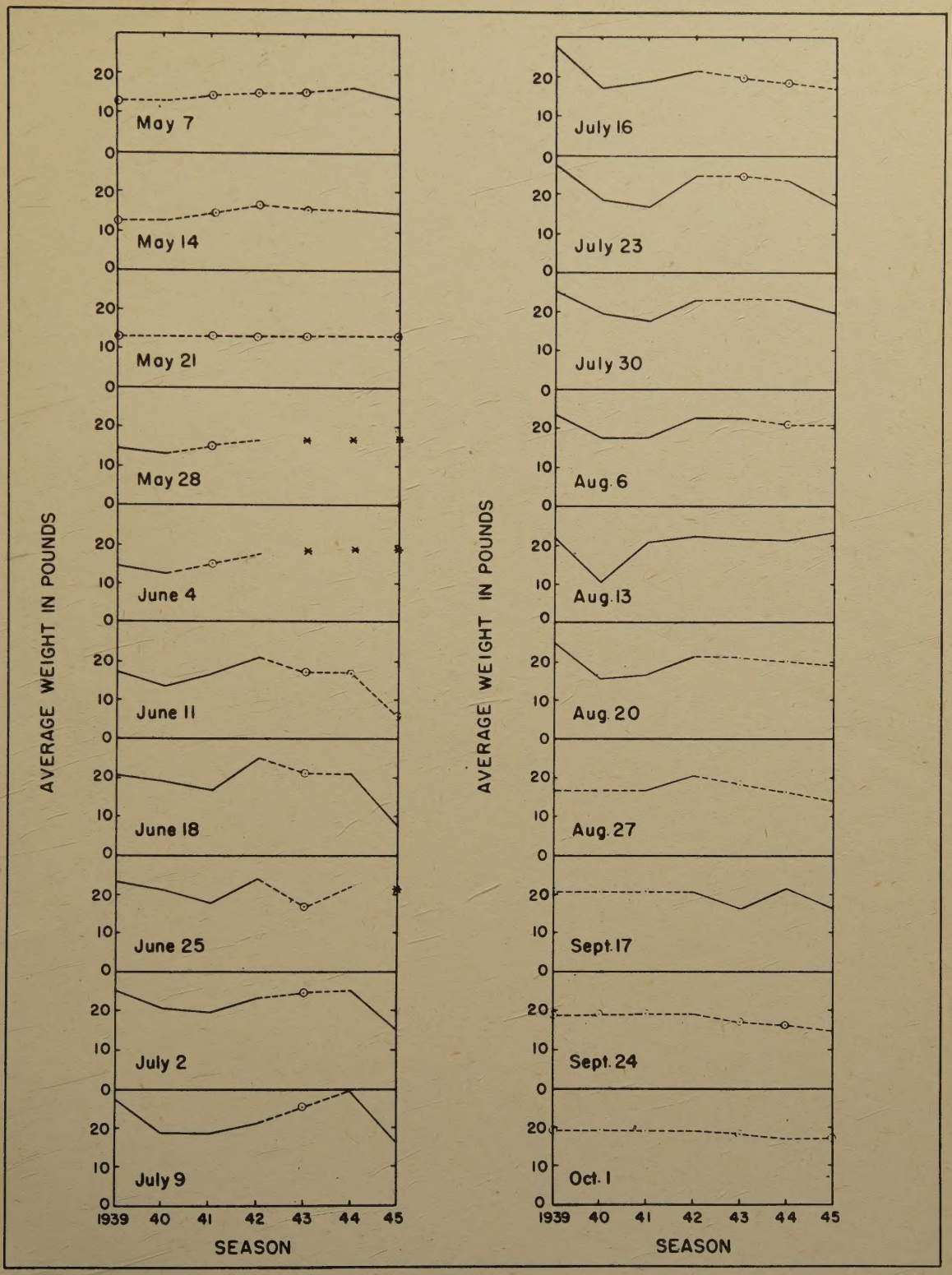

FIGURE 5. Average weights of Columbia River chinook salmon, Zones 3-6, by seasons for individual weeks ending on indicated dates. Circles represent estimated weights; asterisks indicate closed season.

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